Forest Service
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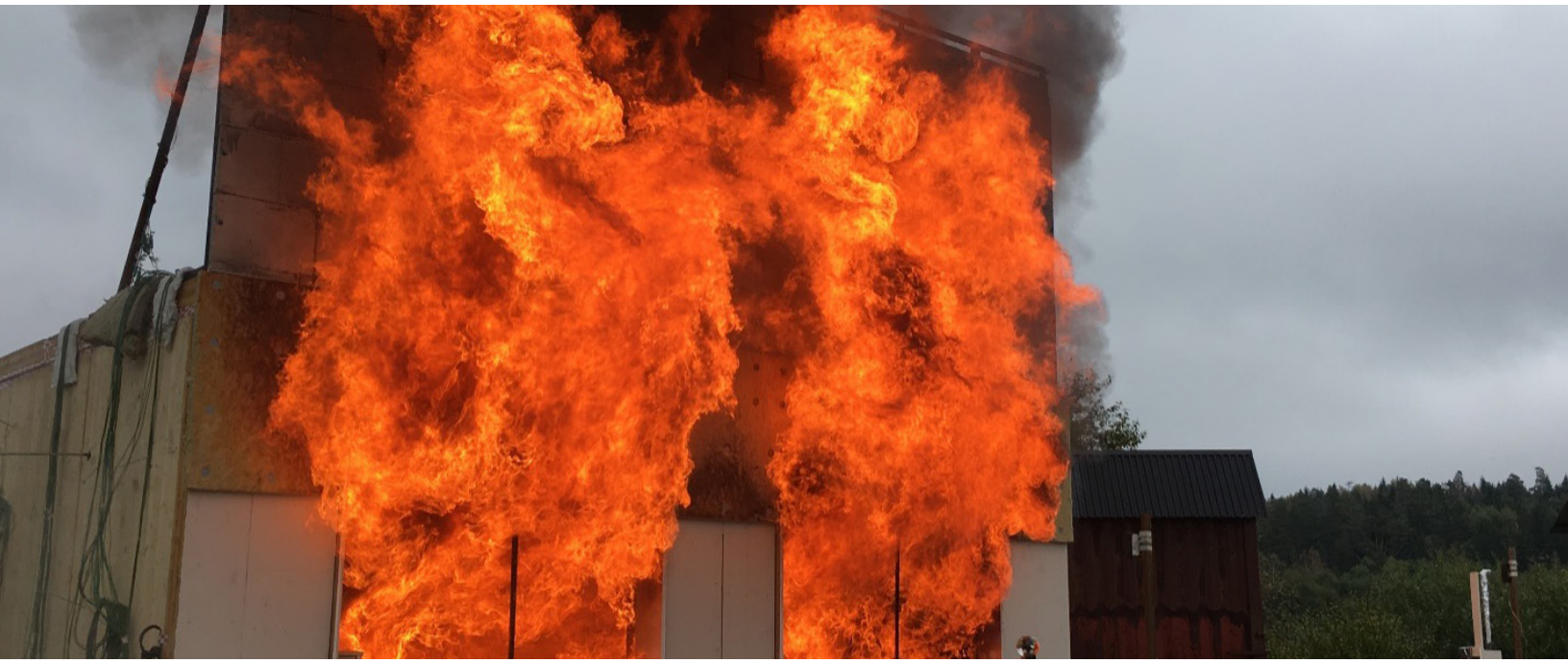

Exterior photo of fully developed fire in the testing compartment. Courtesy photo by the Research Institutes of Sweden.

Fire Tests Lead to Code Changes Supporting Visible Mass Timber Use in Tall Buildings

Mass timber products, such as cross-laminated timber (CLT), can be safely implemented in tall buildings. Yet, the 2021 International Building Code (IBC) has limited the use of visible (i.e., exposed) mass timber in taller structures to achieve specific fire safety objectives. However, recent testing demonstrated that visible mass timber performs well, even in intense fires. As a result, the 2024 IBC will allow for the greater use of exposed mass timber ceilings in structures as high as 12 stories.

The American Wood Council (AWC) and partners in the United States and abroad initiated the testing to evaluate the extent to which mass timber can be exposed and achieve the necessary fire performance. To help fund the work, AWC and its partners secured a $250,000 U.S. Department of Agriculture (USDA), Forest Service Wood Innovations grant, along with $295,000 in cooperative funding, in 2019.

Putting Visible Mass Timber to the Test

The AWC initiative included designing and performing five compartment fire tests in structures constructed using 2021 IBC-compliant CLT. The one-story compartments had fully exposed CLT ceilings and glued laminated beams, and varying combinations of exposed wall area and column surfaces. All other CLT surfaces were covered with gypsum. The fire scenarios were planned to gradually expose more CLT.

Residual cross section of beam, postfire. Courtesy photo by the Research Institutes of Sweden.

Senior research scientist with the Research Institutes of Sweden (RISE) and contractor for the project, Daniel Brandon, Ph.D., explains that the testing scenarios assumed that sprinklers were nonfunctioning, and that fire service intervention was impeded within 4 hours of ignition. In addition, as the tests were performed outside, there were no laboratory restrictions on the heat-release rate limitations, including the contribution from surface area of the exposed mass timber.

While Dr. Brandon says that more research is need on exposed CLT at corner intersections, four of the five tests were successful. This knowledge led directly to the new code pathways for greater adoption of visible mass timber in tall buildings, says Susan Jones, fellow of the American Institute of Architects and principal architect and founder of atelierjones llc.

Jones, a member of the project's steering group and a key consultant, says the testing process challenged conventional thinking about the use of exposed wood. She adds that the interdisciplinary nature of the project team was crucial in the success of the initiative and, ultimately, in changes to the IBC. "My voice represented the thousands of architects, engineers, contractors, and especially owners and developers, nonprofits, and jurisdictions who want to build tall and make an impact at scale on climate change with this lower-carbon material."

Jones credits Kuma Sumathipala, Ph.D., a fellow member of the steering group, for hearing that voice. "He listened and, working with Daniel Brandon, translated it into strict fire and life-safety testing protocols that would stand up to international scrutiny. With IBC adoption of these new building codes, we have an even greater opportunity to expand the market for and the innovative use of renewable forest resources."

More Information

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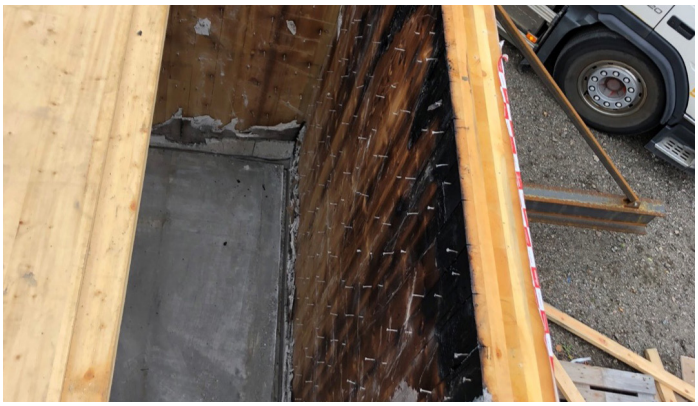
FAST FACTS

- The 2024 International Building Codes (IBC) will allow for expanded use of visible mass timber ceilings in buildings as high as 12 stories.
- Successful fire safety performance testing conducted by American Wood Council (AWC) and its partners was instrumental in the IBC decision.
- The initiative was supported in part by a $250,000 U.S. Department of Agriculture (USDA), Forest Service Wood Innovations grant.



Interior charring along floor and ceiling, as well as at intersecting surfaces, after gypsum layer removal postfire. Courtesy photo by the Research Institutes of Sweden.

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